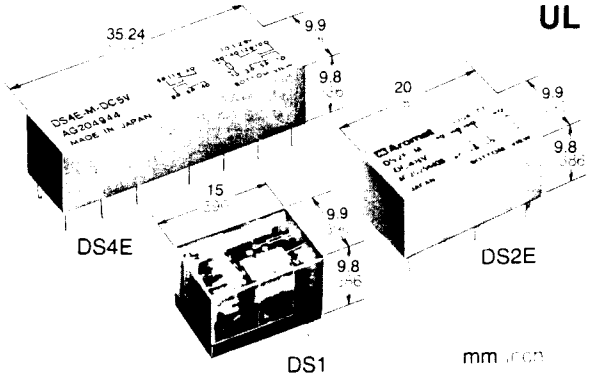
NAiS

HIGHLY SENSITIVE 1500 V FCC SURGE WITHSTANDING MINIATURE RELAY

DS-RELAYS



UL File No.: E57521 CSA File No.: LR26550

- **High sensitivity 200 mW pick-up power**
  100 mW pick-up power types available
- **Latching types available**
- **High switching capacity: 60 W, 125 VA**
- **High breakdown voltage 1,500 V FCC surge between open contacts**
  1,000 V AC between open contacts
- **DIP—1C type can be used with 14 pin IC socket**
  2C type can be used with 16 pin IC socket,
  4C type can be used with 2 sets of 14 pin IC sockets
- **Amber sealed types and available**
- **Gold-cap silver palladium types available for 2 Form C type**
- **Bifurcated contacts are standard.**

SPECIFICATIONS

Contact

Arrangement	1 Form C, 2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)	50 mΩ
Contact material	Gold-clad silver
Rating (resistive)	
Max. switching power	60 W, 125 VA
Max. switching voltage	220 V DC, 250 V AC
Max. switching current	2 A DC, AC
Max. carrying current	3 A DC, AC
UL/CSA rating	0.6 A 125 V AC 0.6 A 110 V DC 2 A 30 V DC
Expected life (min. operations)	
Mechanical (at 600 cpm)	10^8 (1 Form C 2 coil latching type: 10^7)
Electrical 2 A 30 V DC resistive	5×10^5
1 A 30 V DC resistive	2×10^6

*Gold capped silver-palladium contact also available for 2 Form C
10^7 operations at 0.1 A 50 V DC resistive

Coil (polarized) (at 25°C 77 F)

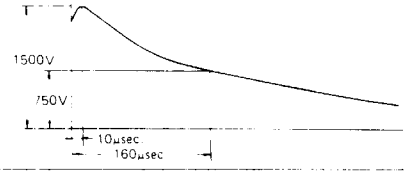
"M" type	Single side stable	Minimum operating power	Approx. 200 mW
		Nominal operating power	Approx. 400 mW
	1 coil latching	Minimum set and reset power	Approx. 90 mW
		Nominal set and reset power	Approx. 180 mW
	2 coil latching	Minimum set and reset power	Approx. 180 mW
		Nominal set and reset power	Approx. 360 mW
"S" type	Single side stable	Minimum operating power	Approx. 100 mW (128 mW)*
		Nominal operating power	Approx. 200 mW
	1 coil latching	Minimum set and reset power	Approx. 45 mW (58mW)*
		Nominal set and reset power	Approx. 90 mW
	2 coil latching	Minimum set and reset power	Approx. 90 mW (115 mW)*
		Nominal set and reset power	Approx. 180 mW

*For 1 Form C high sensitive types.

Characteristics (at 25°C 77 F, 50% Relative humidity)

Max. operating speed		20 cpm at rated load 50 cps at low level load	
Operate time* (at nominal voltage)		Min. 10 msec. (Approx. 3 msec.)	
Release time* (at nominal voltage)		Min. 5 msec. (Approx. 2 msec.)	
Set time (latching) (at nominal voltage)		Approx. 3 msec.	
Reset time (latching) (at nominal voltage)		Approx. 3 msec.	
Initial breakdown voltage		(DS1-S type)	(Other types)
Between open contacts		500 Vrms	1,000 Vrms
Between contact sets		—	1,000 Vrms
Between contacts and coil		1,000 Vrms	1,500 Vrms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)	
FCC** surge voltage between contacts and coil		1,500 V (Except DS1-S type)	
Temperature rise (at nominal voltage)		Max. 65°C	
Ambient temperature		−40°C to +70°C −40 F to +158 F	
Shock resistance	Functional	1C, 2C: Min. 490 m/s² (50 G) 4C: Min. 294 m/s² (30 G)	
	Destructive	Min. 980 m/s² (100 G)	
Vibration resistance	Functional	196 m/s² (20 G), 10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	294 m/s² (30 G), 10 to 55 Hz at double amplitude of 5 mm	
Unit weight		1 Form C: Approx. 3.2 g 2 Form C: Approx. 4 g 4 Form C: Approx. 7 g	

* Excluding contact bounce time
**FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



ORDERING INFORMATION

Ex. DS 2 E — M L2 — DC 48V — R

Contact arrangement	Classification of type	Sensitivity	Operating function	Coil voltage
1: 1 Form C	Nil: Standard type	M: 400 mW nominal operating power	Nil: Single side stable	DC 1.5, 3, 5, 6,
2: 2 Form C	E: Amber sealed type	S: 200 mW nominal operating power	L: 1 coil latching	9, 12, 24, 48 V
4: 4 Form C			L2: 2 coil latching	

(Notes) 1. *Reverse polarity types available (Add suffix -R)
2. Standard packing: Carton: 50 pcs. Case: 500 pcs.

TYPICAL APPLICATIONS

- Telecommunication equipment
- Office equipment
- Computer peripherals
- Security equipment
- Measuring instrumentation

TYPES AND COIL DATA at 20°C 68°F

Single side stable

	Nominal voltage, V DC	*Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	*Maximum allowable, V DC (at 50°C 122°F)	Coil resistance, Ω (±10%)
"M" type	1.5	1.05	0.15	1.8 2.25	5.63
	3	2.1	0.3	3.6 4.5	22.5
	5	3.5	0.5	6 7.5	62.5
	6	4.2	0.6	7.2 9	90
	9	6.3	0.9	10.8 13.5	203
	12	8.4	1.2	14.4 18	360
	24	16.8	2.4	28.8 36	1440
	48	33.6	4.8	57.6 72	5760
"S" type	1.5	1.2 1.05	0.15	2.4 3	11.3
	3	2.4 2.1	0.3	4.8 6	45
	5	4.0 3.5	0.5	8.0 10	125
	6	4.8 4.2	0.6	9.6 12	180
	9	7.2 6.3	0.9	14.4 18	405
	12	9.6 8.4	1.2	19.2 24	720
	24	19.2 16.8	2.4	38.4 48	2880
	48	38.4 33.6	4.8	76.8 96	11520

1 coil latching

	Nominal voltage, V DC	*Reset Set, V DC (max.)	*Maximum allowable, V DC (at 50°C 122°F)	Coil resistance, Ω (±10%)
"M" type	1.5	1.05	1.8 2.25	12.5
	3	2.1	3.6 4.5	50
	5	3.5	6 7.5	139
	6	4.2	7.2 9	200
	9	6.3	10.8 13.5	450
	12	8.4	14.4 18	800
	24	16.8	28.8 36	3200
	48	33.6	57.6 72	12800
"S" type	1.5	1.2 1.05	2.4 3	25
	3	2.4 2.1	4.8 6	100
	5	4.0 3.5	8.0 10	278
	6	4.8 4.2	9.6 12	400
	9	7.2 6.3	14.4 18	900
	12	9.6 8.4	19.2 24	1600
	24	19.2 16.8	38.4 48	6400
	48	38.4 33.6	76.8 96	25600

2 coil latching

	Nominal voltage, V DC	*Reset Set, V DC (max.)	*Maximum allowable, V DC (at 50°C 122°F)	Coil resistance, Ω (±10%) Coil I	Coil II
"M" type	1.5	1.05	1.8 2.25	6.25	
	3	2.1	3.6 4.5	25	
	5	3.5	6 7.5	69.4	
	6	4.2	7.2 9	100	
	9	6.3	10.8 13.5	225	
	12	8.4	14.4 18	400	
	24	16.8	28.8 36	1600	
	48	33.6	57.6 72	6400	
"S" type	1.5	1.2 1.05	2.4 3	12.5	
	3	2.4 2.1	4.8 6	50	
	5	4.0 3.5	8.0 10	139	
	6	4.8 4.2	9.6 12	200	
	9	7.2 6.3	14.4 18	450	
	12	9.6 8.4	19.2 24	800	
	24	19.2 16.8	38.4 48	3200	
	48	38.4 33.6	76.8 96	12800	

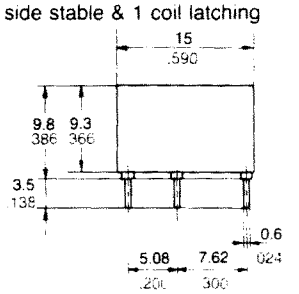
*Top: 1 Form C
Bottom: 2, 4 Form C

DIMENSIONS

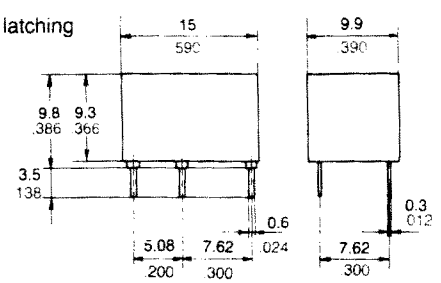
mm inch

1 Form C General tolerance: ±0.3 ±.012

Single side stable & 1 coil latching



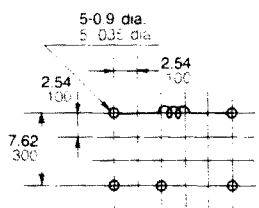
2 coil latching



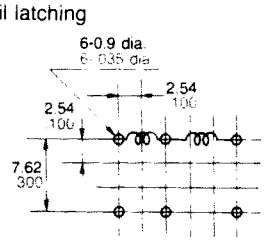
PC board pattern (Copper-side view)

Tolerance: ±0.1 ±.004

Single side stable & 1 coil latching



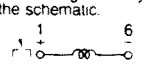
2 coil latching



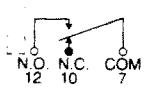
Schematic (Bottom view)

• A polarity bar showing the relay direction can replace the schematic.

Single side stable



Deenergized condition



1 coil latching

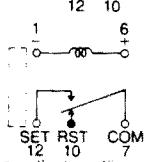


Diagram shows the "reset" position when terminals 1 and 6 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

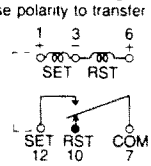


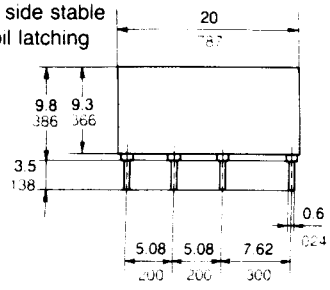
Diagram shows the "reset" position when terminals 3 and 6 are energized. Energize terminals 1 and 3 to transfer contacts.

mm inch

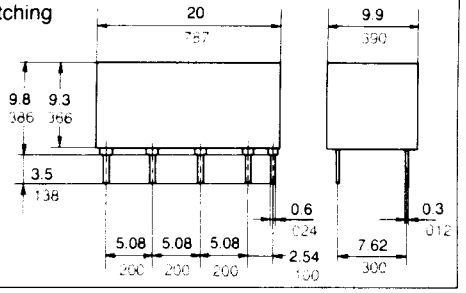
2 Form C

General tolerance: ±0.3 ±.012

Single side stable & 1 coil latching



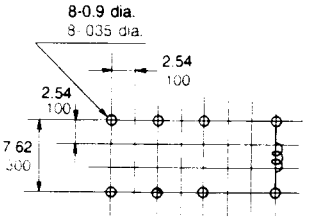
2 coil latching



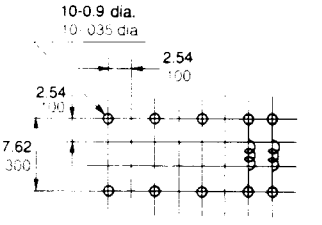
PC board pattern (Copper-side view)

Tolerance: ±0.1 ±.004

Single side stable & 1 coil latching



2 coil latching



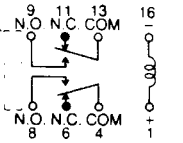
matching 16 pin IC socket

Schematic (Bottom view)

• A polarity bar showing the relay direction can replace the schematic.

Single side stable

Deenergized condition



1 coil latching

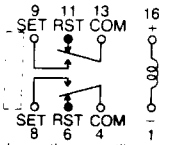


Diagram shows the "reset" position when terminals 1 and 16 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

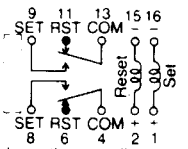


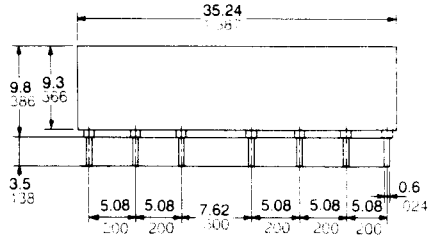
Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

mm inch

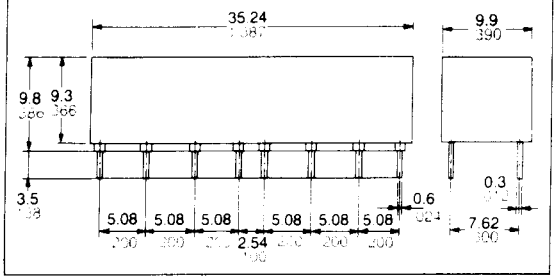
4 Form C

General tolerance: ±0.3 ±.012

Single side stable & 1 coil latching



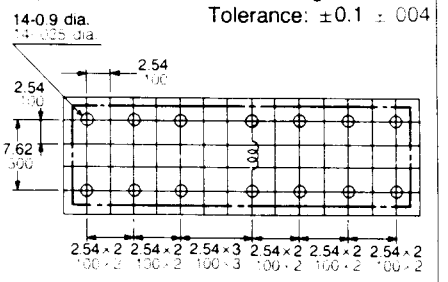
2 coil latching



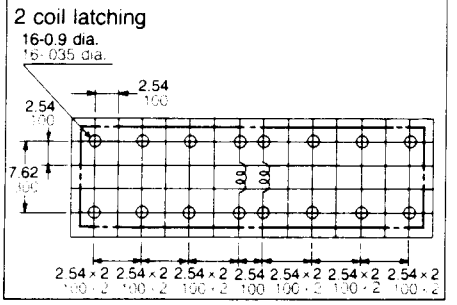
PC board pattern (Copper-side view)

Single side stable & 1 coil latching

Tolerance: ±0.1 ±.004



2 coil latching

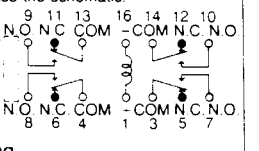


Schematic (Bottom view)

• A polarity bar showing the relay direction can replace the schematic.

Single side stable

Deenergized condition



1 coil latching

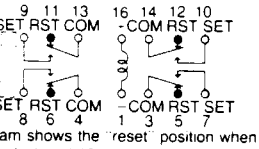


Diagram shows the "reset" position when terminals 1 and 16 are energized. Energize with reverse polarity to transfer contacts.

2 coil latching

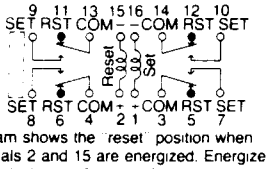


Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

OPERATING PRINCIPLE - 4 Form C

DS4 (Single side stable)

Fig. 1 Deenergized position

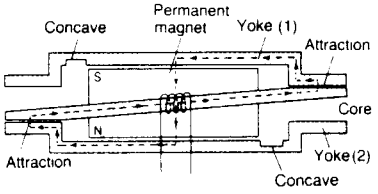


Fig. 2 Energized position

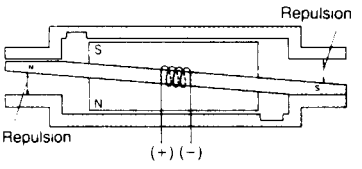
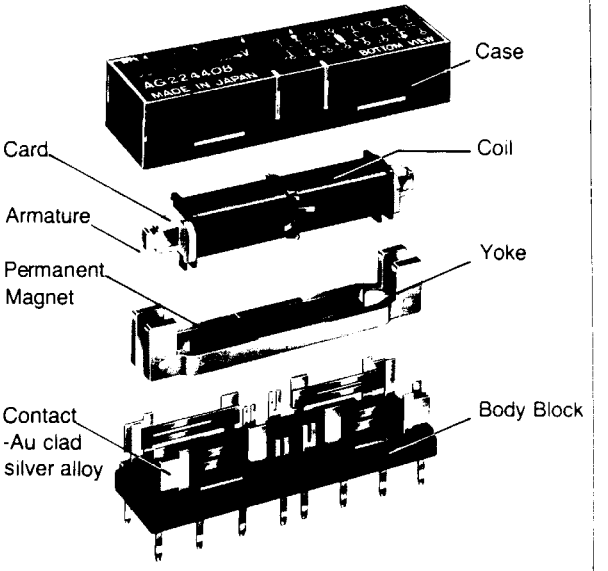


Fig. 1 shows the deenergized position of single side stable versions. Concaves both in yoke (1) and yoke (2) create an unbalance of the magnetic circuit. Therefore the armature is attracted to the yoke (1) and yoke (2) as shown due to the magnetic flux of the permanent magnet.
Energized condition is illustrated in Fig. 2. When the armature is energized as shown, the magnetic repulsion-attraction between the yokes takes place rotating the armature. When the power is removed from the coil, contacts return to the original stage as shown in Fig. 1.

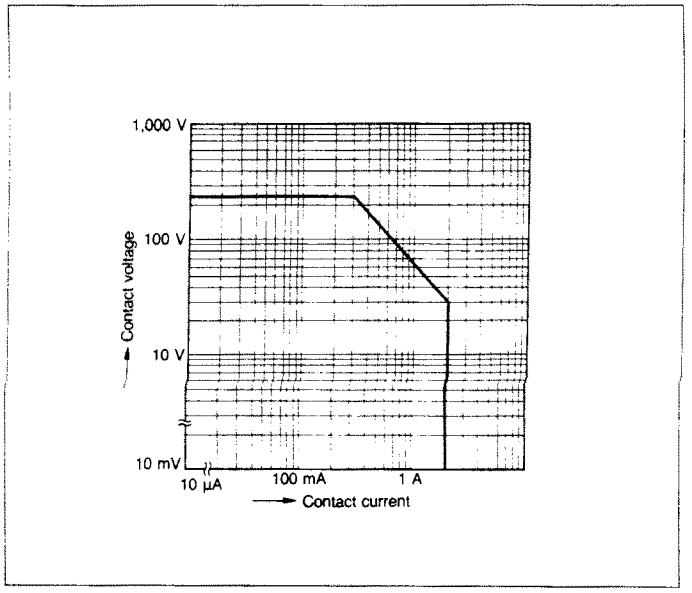
CONSTRUCTION - 4 Form C

Maximum reliability in a high density simplified design

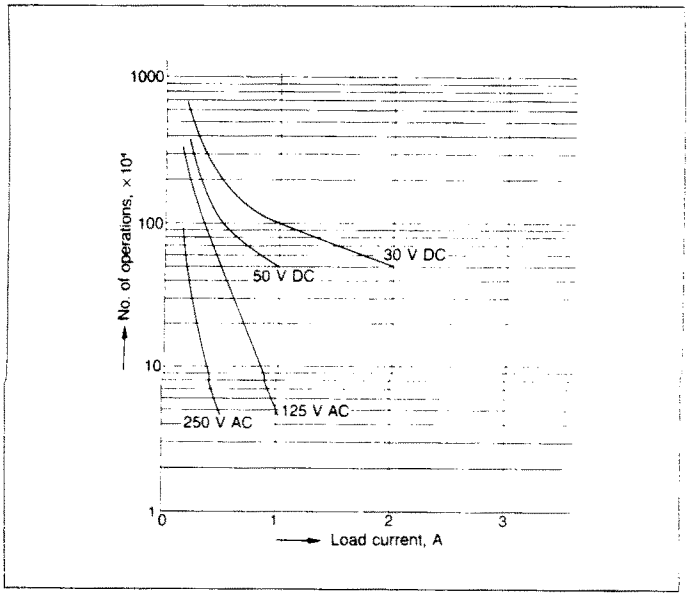


DATA

Maximum switching power

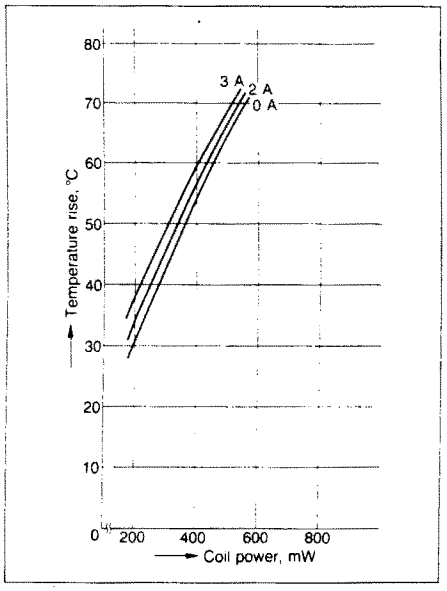


Life curve (Resistive load)

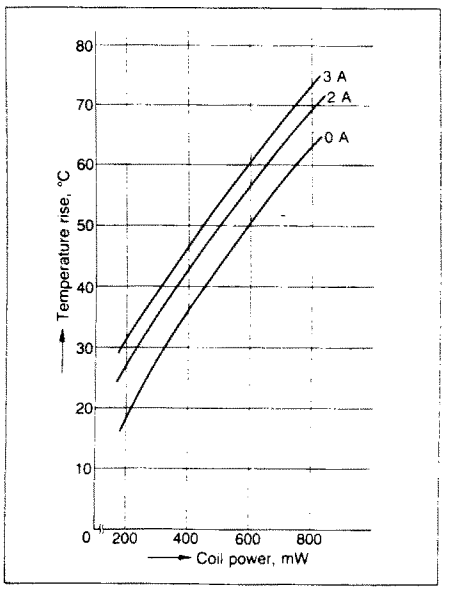


Coil temperature rise (at 20°C 68°F)

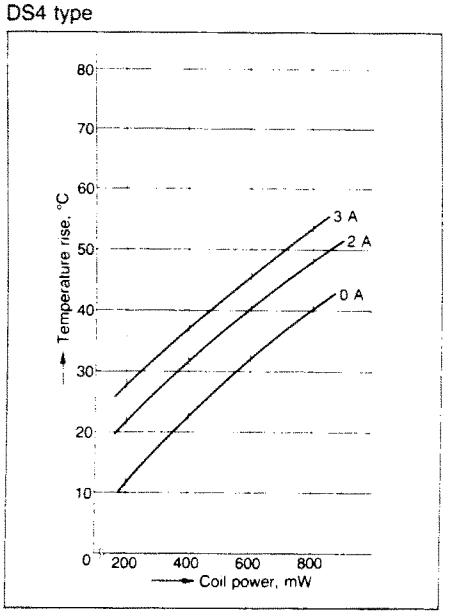
DS1 type



DS2 type

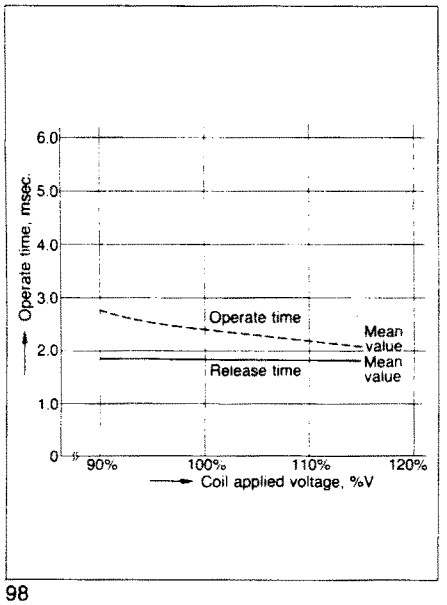


DS4 type

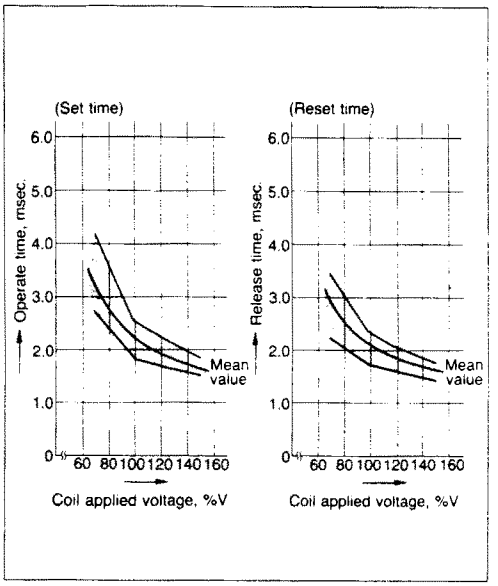


Operate/release time for single side stable (at 20°C 68°F, excluding bounce)

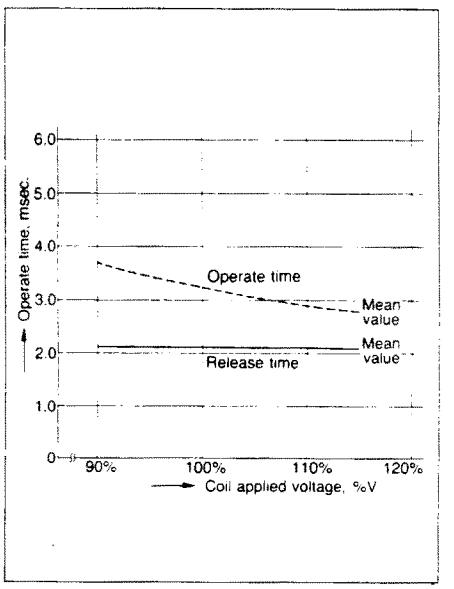
Sample: DS1-M-DC12V



Sample: DS2-ML2-DC12V



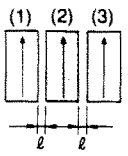
Sample: DS4-M-DC12V



Influence of adjacent mounting

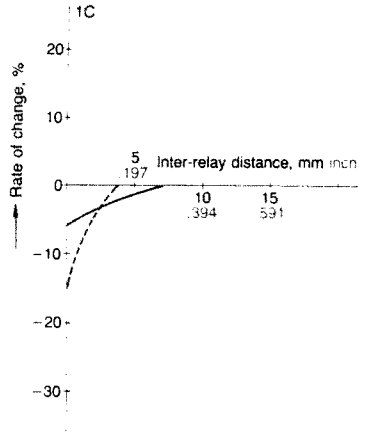
TEST METHOD

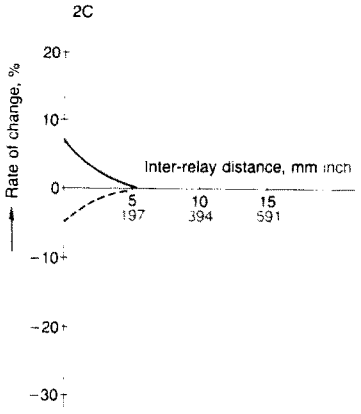
1. Apply nominal voltage to No. (1), and (3) DS relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.

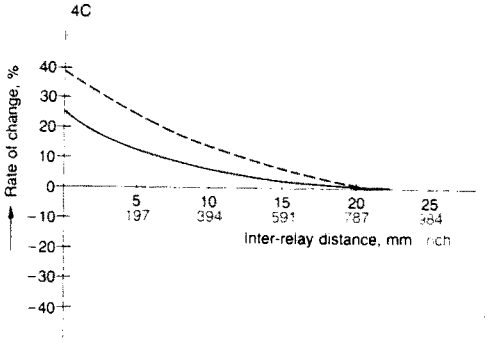


Sample: DS1-M-DC24V
DS2-M-DC24V
DS4-M-DC24V

—— Pick-up voltage
------ Drop-out voltage







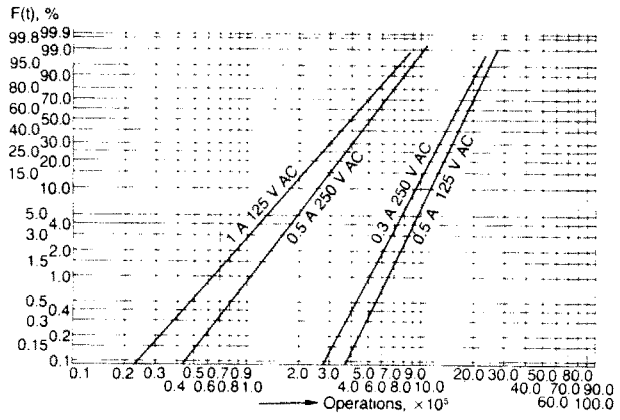
Notes on usage:

1. Although mounting 2 Form C DS relays side-by-side (zero space between the relay cases) will not cause misoperation to occur, the relays should be separated by approximately 5 mm (.197 inches) to completely eliminate the influence of the external magnetic field.
2. In mounting 4 Form C DS relays, care should be excercised to mount them towards the same direction.
3. Under worst-case conditions, mounting 4 Form C DS relays side-by-side (zero space between the relay cases) could cause them to remain in the energized stage. Therefore, the relays should be separated by 5 mm (.197 inches) minimum to assure correct operation.

Weibull probability data

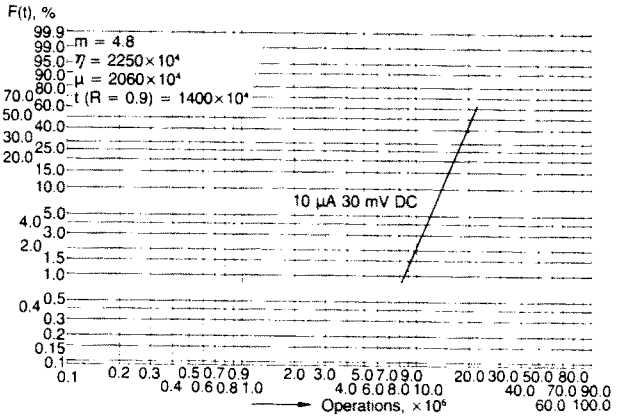
Contact reliability for AC loads
Sample: DS2-M-DC24V
TEST CONDITION

1. Cycle rate: 20 cpm.
2. Load (resistive): 1 A 125 V AC, 0.5 A 250 V AC, 0.3 A 250 V AC, 0.5 A 125 V AC
3. Rejection level: 200 mΩ



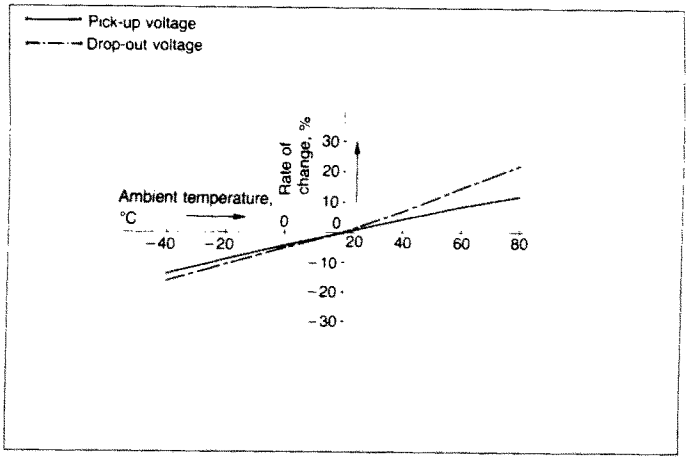
Low-level load test
Sample: DS2-M-DC24V
TEST CONDITION

1. Test equipment: Low-level load contact reliability measuring machine
2. Load: Voltage: 30 mV DC; Current: 10 μA; Kind: Resistance (Metal-grades)
3. Detection level: 200 Ω (1 contact)
4. Detection time: 3 msec.



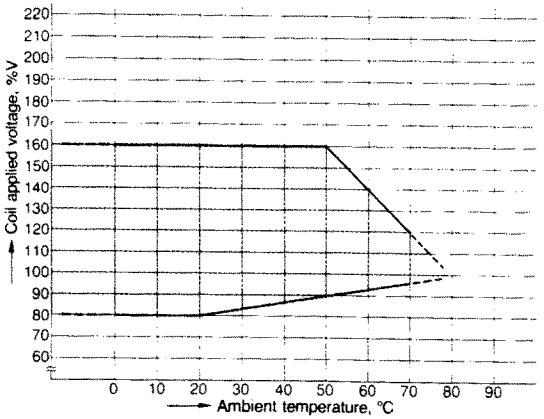
Change of rate of pick-up and drop-out voltage

(Single side stable)

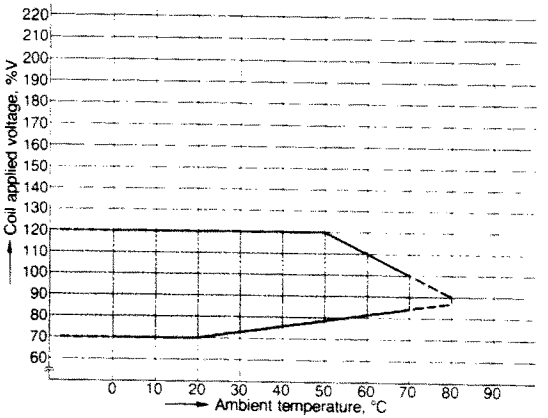


Ambient temperature and operating voltage range

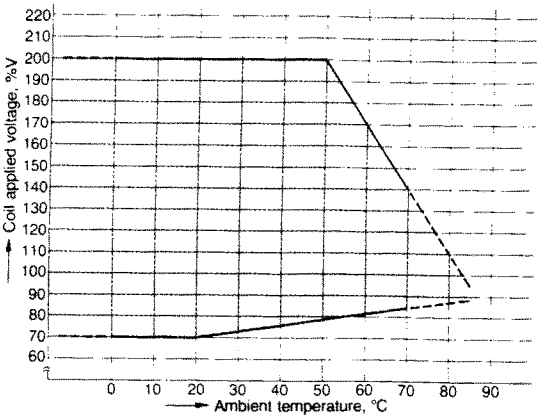
DS1-S type



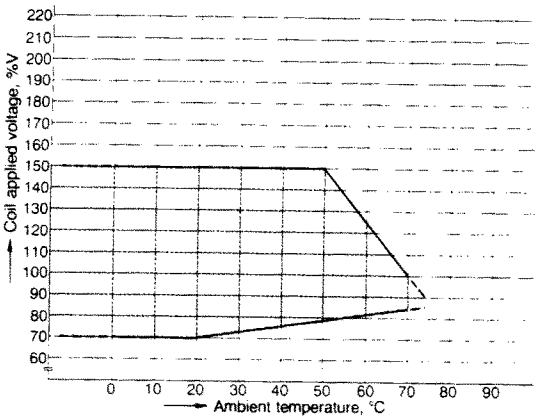
DS1-M type



DS2-S type DS4-S type



DS2-M type DS4-M type



Note: Data assumes that the maximum allowable temperature is 120°C, and is not applicable to hot start.